REMARKS

Claims 1, 3, and 5-7 are pending in this application. By this Office Action, claims 1, 3 and 5-6 are rejected under 35 U.S.C. §103. By this Amendment, claim 7 is added. Support for new claim 7 can be found in the specification as originally filed. No new matter is added.

I. Rejections Under §103

Claims 1, 3 and 5-6 are rejected under 35 U.S.C. §103(a) over Kasai in view of Yoshida and Khaladji. Applicants respectfully traverse this rejection.

A. The Claimed Invention

The claimed invention is directed to a method for polishing a glass hard disk platter, comprising polishing a glass hard disk platter using a stable slurry in which cerium(IV) oxide particles having an average secondary particle size of 0.1 to 0.5 μm are dispersed in water, which contains CeO_2 in a concentration of 0.2 to 30 wt%, and contains a quaternary ammonium ion (NR_4^+, where R is an organic group) in a $(NR_4^+)/(CeO_2)$ molar ratio in a range of 0.001 to 1, wherein a proportion of cerium expressed as a ratio of (cerium oxide)/(cerium oxide + other rare earth oxides) in the cerium(IV) oxide particles is 95% or more based on weight, and the stable slurry is a slurry of surface-modified cerium(IV) oxide obtained by heat-treating cerium(IV) oxide that is obtained by blowing oxygen or a gas containing oxygen into a suspension obtained by reacting a cerium (III) salt with an alkaline substance in a $(OH)/(Ce^{3+})$ molar ratio of 3 to 30, in an aqueous medium in the presence of an ammonium salt having a non-oxidative anionic component selected from the group consisting of ammonium carbonate, ammonium hydrogen carbonate, and mixtures thereof. Such a method is nowhere taught or suggested by the cited references.

The claimed invention thus relates to a method for polishing a glass hard platter using a specific surface-modified cerium(IV) oxide. The cerium(IV) oxide is made by reacting a cerium (III) salt with an alkaline substance to form a suspension, and then oxygen or a gas

containing oxygen is blown into the resulting suspension to obtain cerium(IV) oxide, and thereafter the cerium(IV) oxide is heat-treated in the presence of an ammonium salt having a non-oxidative anionic component. The claimed method using the claimed cerium(IV) oxide slurry provides a good glass hard platter surface having less unevenness due to a chemical/mechanical effect. The claimed method is particularly suitable and advantageous for uses that require precision polishing. See specification at paragraph [0071].

The claimed invention specifies that the slurry contains a quaternary ammonium ion, NR_4^+ where R is an organic group, in a $(NR_4^+)/(CeO_2)$ molar ratio in a range of 0.001 to 1. By adding such a quaternary ammonium ion, the stability of the abrasive liquid is improved. See specification at paragraph [0043].

In addition, the claimed invention enables a polishing speed, and a ratio of polishing speed to average surface roughness, to be increased. This is accomplished by adjusting an abrasive compound such that cerium accounts for 95% or more in terms of oxides of the total amount of rare earth elements in the abrasive compound for polishing the glass disc platter. As a result, the claimed invention allows for improved productivity and reduced cost of the polishing step. See specification at paragraph [0073].

These benefits are specifically disclosed and described in the specification. For example, Table 1 at page 15 of the specification shows the polishing speed and average surface roughness of Examples 1-4 as compared to the Comparative Example 1. In Examples 1-4, where cerium accounts for 95% or more in terms of oxides of the total amount of rare earth elements in the abrasive compound, the abrasive compound provides significantly reduced average surface roughness and increased ratio of polishing speed to average surface roughness, as compared to Comparative Example 1, where cerium accounts for less than 95% (specifically 57%) in terms of oxides of the total amount of rare earth elements in the abrasive compound. These Examples and Comparative Example demonstrate the unexpected results

obtained when the cerium(IV) oxide content is within the claimed range (Examples 1-4) as compared to when the cerium(IV) oxide content is outside of the claimed range (Comparative Example 1).

Still further, claim 1 specifies that the cerium(IV) oxide is specifically a cerium(IV) oxide whose particles have a high hydroxyl group activity on the surface and are produced by oxidizing a hydrolyzate of a cerium salt with oxygen. As a result, many hydroxyl groups (i.e., =C-OH) are generated on the surface of the cerium(IV) oxide particles. This is achieved by heat treating in an aqueous medium in the presence of an ammonium salt having a non-oxidative anionic component. These hydroxyl groups on the surface of the cerium(IV) oxide particles provide a chemical effect on hydroxyl groups (i.e., -Si-OH) on the surface of the silicon oxide film, thus improving the polishing speed. See specification at paragraph [0046]. The resultant specific cerium(IV) oxide particles provide improved chemical and mechanical effects to a glass hard disk that is to be polished.

These benefits are not taught or suggested by the cited references.

B. <u>Kasai Does Not Teach or Suggest the Claimed Invention</u>

The Office Action asserts that Kasai discloses a process for producing cerium(IV) oxide; Yoshida discloses that ceria slurries are useful for polishing magnetic discs, and Khaladji discloses a highly pure cerium oxide. The Office Action thus asserts that it would have been obvious to combine the reference and thereby practice the claimed invention. Applicants disagree.

Kasai discloses a process for producing crystalline ceric oxide particles having a particle diameter of 0.005 to 5 micron, which comprises reacting a cerium (III) salt with an alkaline substance in an (OH)/(Ce^{3+}) molar ratio of 3 to 30 in an aqueous medium in an inert gas atmosphere to produce a suspension of cerium (III) hydroxide, and blowing oxygen or a gas containing oxygen into the suspension at a temperature of 10 to 95°C and at an atmospheric

pressure. Abstract. Kasai discloses that cerium oxide is used for polishing a silicon oxide film or a semiconductor device, quartz glass for a photomask, quartz crystal such as for a crystal oscillator, and the like. However, Kasai is silent as to various claim limitations.

1. Secondary Particle Size

Claim 1 specifically requires that the cerium(IV) oxide particles have an average secondary particle size of 0.1 to 0.5 μm. However, Kasai nowhere teaches or suggests this limitation.

Kasai only broadly discloses crystalline ceric oxide particles having a particle diameter of 0.005 to 5 micron. However, Kasai does not specifically disclose that this size is the secondary particle size, as opposed to a primary particle size, average particle size, or the like.

The term "average secondary particle size" as used in claim 1 is well known in the art and is clearly defined in the specification. See paragraph [0010]. In particular, a sol in which particles are dispersed as single particles or in a state close thereto is referred to as a primary sol. A particle in the primary sol is referred to as a primary particle, and thus the sol can be described as having particles having an average primary particle size. In contrast to a primary sol, a sol can also include aggregates of some primary particles. Such a sol including aggregates of primary particles is referred to as a secondary sol, and the respective aggregates are referred to as secondary particles. Thus, the sol can be described as having particles having an average secondary particle size. The average secondary particle size is a particle size that corresponds to 50% of an accumulated particle size distribution of the secondary particle.

While Kasai broadly discloses particles having a particle diameter of 0.005 to 5 micron, Kasai nowhere teaches or suggests that the particles should specifically have an average secondary particle size of 0.1 to 0.5 μm as claimed. Not only does the claimed range

of 0.1 to 0.5 μm encompass only 8% of the broad 0.005 to 5 micron range of Kasai, but the claimed range also specifically relates to a secondary particle size that refers to the average particle size of aggregates of primary particles.

Because Kasai does not teach or suggest this claim limitation, Kasai would not have rendered obvious the claimed invention.

2. Surface Smoothness

According to Kasai, the cerium (IV) oxide is beneficial in improving polishing speed. However, as is known by those skilled in the art, surface smoothness is another important factor when polishing glass hard discs. Although Kasai asserts improved polishing speed, Kasai is silent with respect to surface smoothness provided by the polishing slurry. Kasai is thus distinct from and does not teach or suggest the claimed invention. In particular, Kasai does not teach or suggest that the polishing method is specifically used for polishing a glass hard disk platter, and does not teach or suggest the surface smoothness provided by the slurry.

3. Specific Slurry Material

Another important property in polishing slurries is the material itself. Kasai also does not teach this factor. In particular, according to the claimed invention, the slurry material is particularly defined and selected, in addition to providing the good polishing speed and surface smoothness. That is, the surface property of the abrasive compound is that the compound is provided with many hydroxyl groups (-Ce-OH) on the surface of the cerium(IV) oxide particles, and by affecting a chemical effect on the hydroxyl groups (-Si-OH) on the surface of the glass hard disc. See specification at paragraph [0046]. In order to provide the surface effect, the proportion of cerium expressed as a ratio of (cerium oxide)/(cerium oxide + other rare earth oxides) in the cerium(IV) oxide particles is 95% or more based on weight.

Kasai does not teach or suggest the specific cerium(IV) oxide slurry that is claimed. Kasai does not teach or suggest that a proportion of cerium expressed as a ratio of (cerium

oxide)/(cerium oxide + other rare earth oxides) in the cerium(IV) oxide particles is 95% or more based on weight. As shown in the Examples and Comparative Example of the instant specification, the ratio of cerium oxide can vary drastically, and thus the claimed ratio is not inherent in the teachings of Kasai. Nor does Kasai teach or suggest the specific claimed cerium(IV) oxide, or the method by which it is made.

In the absence of any express teachings of the claimed ratio or the specific cerium(IV) oxide, Kasai cannot teach or suggest at least these features of the claimed invention. Kasai does not teach or suggest that varying this ratio to 95% or more and providing the specific cerium(IV) oxide would have any beneficial effects, and thus it would not have been obvious to modify Kasai to practice the claimed invention.

Further, Kasai does not teach or suggest that the slurry further includes a quaternary ammonium ion (NR_4^+, where R is an organic group) in a (NR_4^+)/(CeO_2) molar ratio in a range of 0.001 to 1. Such a quaternary ammonium ion increases stability of the slurry, and leads to a lowering of the average surface roughness after polishing. Kasai does not teach or suggest that such benefits could or would be provided by adding such a quaternary ammonium ion.

C. <u>Yoshida and Khaladji Do Not Overcome the Deficiencies of Kasai</u>

Yoshida is cited for the assertion that ceria slurries are known for polishing glass hard discs, and Khaladji is cited for the assertion that high purity starting materials are desired for ceria polishing slurries. However, these disclosure do not remedy the failure of Kasai to teach or suggest all of the limitations of independent claim 1.

Yoshida discloses a cerium oxide abrasive with which the surfaces of substrates such as SiO_2 insulating films can be polished at a high rate without causing scratches. The abrasive comprises a slurry comprising cerium oxide particles whose primary particles have a diameter of from 10 nm to 600 nm and a median diameter of from 30 nm to 250 nm and

slurry particles have a median diameter of from 150 nm to 600 nm and a maximum diameter of 3,000 nm or smaller, the cerium oxide particles being dispersed in a medium. Abstract.

However, Yoshida does not teach or suggest that the polishing method is specifically used for polishing a glass hard disk platter. Nor does Yoshida teach or suggest that a proportion of cerium expressed as a ratio of (cerium oxide)/(cerium oxide + other rare earth oxides) in the cerium(IV) oxide particles is 95% or more based on weight. Yoshida merely discloses cerium oxide used in glass-surface polishing for photomasks, and entirely fails to teach or suggest the proportion of cerium in the total rare earth elements in an abrasive compound. As shown in the Examples and Comparative Example of the instant specification, the ratio of cerium oxide can vary drastically, and thus the claimed ratio is not inherent in the teachings of Yoshida. Nor does Yoshida teach or suggest the specific claimed cerium(IV) oxide, or the method by which it is made.

Although Khaladji may disclose that high purity ceria starting materials are desired, Khaladji does not teach or suggest the specific limitations of claim 1 with respect to the production of the claimed cerium(IV) oxide slurry. The Office Action argues that high purity would be desired, because it would lead to less introduction of impurities into the process. However, the references do not specifically teach or suggest the claim limitations, and thus cannot have rendered those limitations obvious.

Nor does Khaladji teach or suggest the beneficial polishing properties that are provided by the claimed invention, and demonstrated in the present specification.

D. <u>Conclusion</u>

For at least these reasons, the claimed invention would not have been obvious over the cited references. The references fail at least to teach or suggest the claimed method for polishing a glass hard disk platter. Nor do the references teach or suggest a stable slurry containing cerium(IV) oxide particles wherein a proportion of cerium expressed as a ratio of

(cerium oxide)/(cerium oxide + other rare earth oxides) in the cerium(IV) oxide particles is 95% or more based on weight, as claimed. The references also fail to teach or suggest the specific claimed cerium(IV) oxide, or the method by which it is made.

Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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